

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (currently amended): An apparatus for monitoring a size of a particle, comprising:
 - a laser beam source which radiates a laser beam to an area in which particles exist;
 - a photodetector which is comprised of a plurality of pixels, which receives said laser beam having been scattered by said particles, and outputs image data including brightness of pixels; and
 - an area detector which determines as a group only pixels that are simultaneously irradiated by said laser beam scattered by one of said particles, ~~and~~ that are located adjacent to each other, ~~among pixels and that having~~ ~~have~~ a brightness equal to or greater than a predetermined threshold brightness, ~~as a group~~.

2. (previously presented): The apparatus as set forth in claim 1, further comprising:
 - a maximum brightness detector which detects a maximum brightness among levels of brightness of pixels in said group; and
 - a measurement unit which compares said maximum brightness to said predetermined threshold brightness to thereby measure a relative size of said particles.

3. (previously presented): The apparatus as set forth in claim 1, further comprising:
a maximum brightness detector which detects a maximum brightness among levels of
brightness of pixels in said group; and

a measurement unit which measures an intensity of said scattered laser beam, based on
said maximum brightness, and measures a relative size of said particles, based on said intensity
of said scattered laser beam, in accordance with an equation which defines a relation between an
intensity of a scattered laser beam and a relative size of particles.

4. (previously presented): The apparatus as set forth in claim 3, wherein said
particles are generated in fabrication of a semiconductor device, and further comprising a third
measurement unit which judges whether a relative size of said particles is greater than a
predetermined threshold size in order to judge whether said particles would exert harmful
influence on a semiconductor device, and which ceases fabrication of a semiconductor device, if
said relative size of said particles has been judged to be greater than said predetermined
threshold size.

5. (original): The apparatus as set forth in claim 1, further comprising a scanner
which scans said laser beam emitted from said laser beam source.

6. (original): The apparatus as set forth in claim 1, wherein said photodetector includes a charge coupled device camera comprised of a plurality of light-receiving devices arranged in a matrix.

7. (previously presented): The apparatus as set forth in claim 2, further comprising a counter which counts up a number of said groups.

8. (original): The apparatus as set forth in claim 1, further comprising a heater for heating a chamber in which said particle is generated, to remove by-products from said chamber.

9. (previously presented): The apparatus as set forth in claim 1, further comprising: a counter which counts a number of pixels in said group; and a measurement unit which compares said number to a predetermined threshold number to thereby measure a relative size of said particles.

10. (previously presented): The apparatus as set forth in claim 1, further comprising a counter which counts up a number of said groups.

11. (original): The apparatus as set forth in claim 9, further comprising a scanner which scans said laser beam emitted from said laser beam source.

12. (original): The apparatus as set forth in claim 9, wherein said photodetector includes a charge coupled device camera comprised of a plurality of light-receiving devices arranged in a matrix.

13. (previously presented): The apparatus as set forth in claim 9, further comprising a counter which counts up a number of said groups.

14. (original): The apparatus as set forth in claim 9, further comprising a heater for heating a chamber in which said particle is generated, to remove by-products from said chamber.

15. (previously presented): The apparatus as set forth in claim 1, further comprising: a calculator which calculates a total of brightness of pixels in said group; and a measurement unit which compares said total to a predetermined threshold total to thereby measure a relative size of said particles.

16. (canceled)

17. (previously presented): The apparatus as set forth in claim 1, further comprising: a maximum brightness detector which detects a maximum brightness among levels of brightness of pixels in said group; a counter which counts a number of pixels in said group; and

a measurement unit which compares said maximum brightness or said number to a predetermined threshold brightness or a predetermined threshold number to thereby measure a relative size of said particles.

18. (previously presented): The apparatus as set forth in claim 1, further comprising:
a maximum brightness detector which detects a maximum brightness among levels of brightness of pixels in said group;
a counter which counts a number of pixels in said group;
a calculator which calculates a total of brightness of pixels in said group; and
a measurement unit which uses at least one of said total and said maximum brightness and said number in order to measure a relative size of said particles.

19. (original): The apparatus as set forth in claim 15, further comprising a scanner which scans said laser beam emitted from said laser beam source.

20. (original): The apparatus as set forth in claim 15, wherein said photodetector includes a charge coupled device camera comprised of a plurality of light-receiving devices arranged in a matrix.

21. (previously presented) The apparatus as set forth in claim 15, further comprising a counter which counts up a number of said groups.

22. (original): The apparatus as set forth in claim 15, further comprising a heater for heating a chamber in which said particle is generated, to remove by-products from said chamber.

23. (previously presented): The apparatus as set forth in claim 1, further comprising:
a first measurement unit which measures an intensity of said scattered laser beam, based on brightness of pixels in said group; and
a second measurement unit which measures a relative size of said particles, based on said intensity of said scattered laser beam, in accordance with an equation which defines a relation between an intensity of a scattered laser beam and a relative size of particles.

24. (previously presented): The apparatus as set forth in claim 23, wherein said first measurement unit comprises a maximum brightness detector which detects a maximum brightness among levels of brightness of pixels in said group, and said first measurement unit measures an intensity of said scattered laser beam, based on said maximum brightness.

25. (previously presented): The apparatus as set forth in claim 23, wherein said particles are generated in fabrication of a semiconductor device, and further comprising a third measurement unit which judges whether a relative size of said particles is greater than a predetermined threshold size in order to judge whether said particles would exert harmful influence on a semiconductor device, and which ceases fabrication of a semiconductor device, if

said relative size of said particles has been judged to be greater than said predetermined threshold size.

26. (original): The apparatus as set forth in claim 23, further comprising a scanner which scans said laser beam emitted from said laser beam source.

27. (original): The apparatus as set forth in claim 23, wherein said photodetector includes a charge coupled device camera comprised of a plurality of light-receiving devices arranged in a matrix.

28. (previously presented): The apparatus as set forth in claim 23, further comprising a counter which counts up a number of said groups.

29. (original): The apparatus as set forth in claim 23, wherein said second measurement unit includes a memory which stores a software program used for calculating a size of a particle in accordance with the equation of Rayleigh scattering, and a threshold size to which a calculated size is to be compared.

30. (original): The apparatus as set forth in claim 29, wherein said threshold size is equal to or smaller than a minimum diameter among diameters of wirings in a semiconductor device to be fabricated.

31. (original): The apparatus as set forth in claim 23, further comprising a heater for heating a chamber in which said particle is generated, to remove by-products from said chamber.

32. (currently amended): A method of monitoring a size of a particle, comprising:
radiating a laser beam to an area in which particles exist;
receiving said laser beam having been scattered by said particles with a photodetector comprised of a plurality of pixels, and creating image data including brightness of said pixels;
and

determining as a group only pixels that are simultaneously irradiated by said laser beam scattered by one of said particles, and that are located adjacent to each other, and that among pixels having have a brightness equal to or greater than a predetermined threshold brightness, as a group.

33. (previously presented): The method as set forth in claim 32, further comprising:
detecting a maximum brightness among levels of brightness of pixels in said group; and
comparing said maximum brightness to a predetermined threshold brightness to thereby measure a relative size of said particles.

34. (previously presented): The method as set forth in claim 32, further comprising:
detecting a maximum brightness among levels of brightness of pixels in said group; and

measuring an intensity of said scattered laser beam based on said maximum brightness.

35. (previously presented): The method as set forth in claim 34, wherein said particles are generated in fabrication of a semiconductor device, and further comprising the steps of:

judging whether a relative size of said particles is greater than a predetermined threshold size in order to judge whether said particles would exert harmful influence on a semiconductor device; and

ceasing fabrication of a semiconductor device, if said relative size of said particles has been judged to be greater than said predetermined threshold size.

36. (original): The method as set forth in claim 35, further comprising the step of heating a chamber in which said particles are generated, for removing by-products from said chamber.

37. (original): The method as set forth in claim 32, further comprising the step of scanning said laser beam.

38. (previously presented): The method as set forth in claim 33, further comprising: counting up a number of said groups.

39. (previously presented): The method as set forth in claim 32, comprising:
counting a number of pixels in said group; and
comparing said number to a predetermined threshold number to thereby measure a
relative size of said particles.

40. (canceled)

41. (original): The method as set forth in claim 39, further comprising the step of
scanning said laser beam.

42. (previously presented): The method as set forth in claim 39, further comprising
counting up a number of said groups.

43. (previously presented): The method as set forth in claim 32, comprising:
calculating a total of brightness of pixels in said group; and
comparing said total to a predetermined threshold brightness to thereby measure a
relative size of said particles.

44. (canceled)

45. (original): The method as set forth in claim 43, wherein said particles are generated in fabrication of a semiconductor device, and further comprising the steps of: judging whether said relative size of said particles is greater than a predetermined threshold size in order to judge whether said particles would exert harmful influence on a semiconductor device; and ceasing fabrication of a semiconductor device, if said relative size of said particles has been judged to be greater than said predetermined threshold size.

46. (original): The method as set forth in claim 43, further comprising the step of heating a chamber in which said particles are generated, for removing by-products from said chamber.

47. (original): The method as set forth in claim 43, further comprising the step of scanning said laser beam.

48. (previously presented): The method as set forth in claim 43, further comprising counting up a number of said groups.

49. (previously presented): The method as set forth in claim 43, further comprising storing a software program used for calculating a size of a particle in accordance with the

equation of Rayleigh scattering, and a threshold size to which a calculated size is to be compared.

50. (original): The method as set forth in claim 49, wherein said threshold size is equal to or smaller than a minimum diameter among diameters of wirings in a semiconductor device to be fabricated.

51. (previously presented): The method as set forth in claim 32, comprising:
measuring an intensity of said scattered laser beam, based on brightness of pixels in said group; and

measuring a relative size of said particles, based on said intensity of said scattered laser beam, in accordance with an equation which defines a relation between an intensity of a scattered laser beam and a relative size of particles.

52. (canceled)

53. (original): The method as set forth in claim 51, wherein said particles are generated in fabrication of a semiconductor device, and further comprising the steps of:
judging whether said relative size of said particles is greater than a predetermined threshold size in order to judge whether said particles would exert harmful influence on a semiconductor device; and

ceasing fabrication of a semiconductor device, if said relative size of said particles has been judged to be greater than said predetermined threshold size.

54. (original): The method as set forth in claim 53, further comprising the step of heating a chamber in which said particles are generated, for removing by-products from said chamber.

55. (original): The method as set forth in claim 51, further comprising the step of scanning said laser beam.

56. (previously presented): The method as set forth in claim 51, further comprising counting up a number of said groups.

57. (previously presented): The method as set forth in claim 51, further comprising the step of storing a software program used for calculating a size of a particle in accordance with the equation of Rayleigh scattering, and a threshold size to which a calculated size is to be compared.

58. (original): The method as set forth in claim 57, wherein said threshold size is equal to or smaller than a minimum diameter among diameters of wirings in a semiconductor device to be fabricated.

59. - 102. (canceled)

103. (currently amended): A recording medium readable by a computer, storing a program therein for causing a computer to act as an apparatus for monitoring a size of a particle, said apparatus comprising:

a laser beam source which radiates a laser beam to an area in which particles exist;
a photodetector which is comprised of a plurality of pixels, wherein said photodetector receives said laser beam having been scattered by said particles, and outputs image data including brightness of pixels; and

an area detector which determines as a group only pixels that are simultaneously irradiated by said laser beam scattered by one of said particles, ~~and~~ that are located adjacent to each other, ~~among pixels and that having~~ have a brightness equal to or greater than a predetermined threshold brightness, ~~as a group~~.

104. (previously presented): The recording medium as set forth in claim 103, wherein said apparatus further comprises:

a maximum brightness detector which detects a maximum brightness among levels of brightness of pixels in said group; and
a measurement unit, which compares said maximum brightness to a predetermined threshold brightness to thereby measure a relative size of said particles.

105. (previously presented): The recording medium as set forth in claim 103, wherein said apparatus further comprises:

a maximum brightness detector which detects a maximum brightness among levels of brightness of pixels in said group; and

a measurement unit which measures an intensity of said scattered laser beam, based on said maximum brightness, and measures a relative size of said particles, based on said intensity of said scattered laser beam, in accordance with an equation which defines a relation between an intensity of a scattered laser beam and a relative size of particles.

106. (previously presented): The recording medium as set forth in claim 103, wherein said particles are generated in fabrication of a semiconductor device, and wherein said apparatus further includes a measurement unit which judges whether a relative size of said particles is greater than a predetermined threshold size in order to judge whether said particles would exert harmful influence on said semiconductor device, and which ceases fabrication of said semiconductor device, if said relative size of said particles has been judged to be greater than said predetermined threshold size.

107. (previously presented): The recording medium as set forth in claim 103, wherein said apparatus further includes a particle counter which counts up each time said particle counter

receives a signal from said area detector, and transmits a signal indicative of a count, to a measurement, unit.

108. (previously presented): The recording medium as set forth in claim 103, wherein said apparatus further includes a heater for heating a chamber in which said particle is generated, to remove by-products from said chamber.

109. (previously presented): The recording medium as set forth in claim 103, wherein said apparatus further includes a counter which counts up a number of said groups.

110. (previously presented): The recording medium as set forth in claim 103, wherein said apparatus further includes:

 a counter which counts a number of pixels in said group; and
 a measurement unit which compares said number to a predetermined threshold number to thereby measure a relative size of said particles.

111. (previously presented): The recording medium as set forth in claim 103, wherein said apparatus further includes a scanner which scans said laser beam emitted from said laser beam source.

112. (previously presented): The recording medium as set forth in claim 103, wherein said photodetector includes a charge coupled device camera comprised of a plurality of light-receiving devices arranged in a matrix.

113. (previously presented): The recording medium as set forth in claim 103, wherein said apparatus further includes:

a calculator which calculates a total of brightness of pixels in said group;
and

a measurement unit which compares said total to a predetermined threshold total to thereby measure a relative size of said particles.

114. (previously presented): The recording medium as set forth in claim 103, wherein said apparatus further includes:

a maximum brightness detector which detects a maximum brightness among levels of brightness of pixels in said group;

a counter which counts a number of pixels in said group; and
a measurement unit which compares said maximum brightness or said number to a predetermined threshold brightness, or a predetermined threshold number, to thereby measure a relative size of said particles.

115. (previously presented): The recording medium as set forth in claim 103, wherein said apparatus further includes:

a maximum brightness detector which detects a maximum brightness among levels of brightness of pixels in said group;
a counter which counts a number of pixels in said group;
a calculator which calculates a total of brightness of pixels in said group; and
a measurement unit which uses at least one of said total and said maximum brightness and said number in order to measure a relative size of said particles.

116. (previously presented): The recording medium as set forth in claim 103, wherein said apparatus further includes:

a first measurement unit which measures an intensity of said scattered laser beam, based on brightness of pixels in said group; and
a second measurement unit which measures a relative size of said particles, based on said intensity of said scattered laser beam, in accordance with an equation which defines a relation between an intensity of a scattered laser beam and a relative size of particles.

117. (previously presented): The recording medium as set forth in claim 116, wherein said first measurement unit comprises a maximum brightness detector which detects a maximum brightness among levels of brightness of pixels in said group, and said first measurement unit measures an intensity of said scattered laser beam, based on said maximum brightness.

118. (previously presented): The recording medium as set forth in claim 116, wherein said second measurement unit includes a memory which stores a software program used for calculating a size of a particle in accordance with the equation of Rayleigh scattering, and a threshold size to which a calculated size is to be compared.

119. (currently amended): A recording medium readable by a computer, storing a program therein for causing a computer to carry out a method of monitoring a size of a particle, said method comprising:

radiating a laser beam to an area in which particles exist;

receiving said laser beam having been scattered by said particles; and

determining as a group only pixels that are simultaneously irradiated by said laser beam scattered by one of said particles, ~~and~~ that are located adjacent to each other, ~~among pixels and~~
~~that having have~~ a brightness equal to or greater than a predetermined threshold brightness, ~~as a~~
~~group.~~

120. (previously presented): The recording medium as set forth in claim 119, wherein said method further includes:

detecting a maximum brightness among levels of brightness of pixels in said group; and

comparing said maximum brightness to a predetermined threshold brightness to thereby

measure a relative size of said particles.

121. (previously presented): The recording medium as set forth in claim 119, wherein said method further includes:

detecting a maximum brightness among levels of brightness of pixels in said group; and measuring an intensity of said scattered laser beam, based on said maximum brightness.

122. (previously presented): The recording medium as set forth in claim 119, wherein said particles are generated in fabrication of a semiconductor device, and wherein said method further includes:

judging whether a relative size of said particles is greater than a predetermined threshold size in order to judge whether said particles would exert harmful influence on said semiconductor device; and

ceasing fabrication of said semiconductor device, if said relative size of said particles has been judged to be greater than said predetermined threshold size.

123. (previously presented): The recording medium as set forth in claim 122, wherein said method further includes heating a chamber in which said particles are generated, for removing by-products from said chamber.

124. (previously presented): The recording medium as set forth in claim 119, wherein said method further includes counting up a number of said groups.

125. (previously presented): The recording medium as set forth in claim 119, wherein said method further includes:

counting a number of pixels in said group; and

comparing said number to a predetermined threshold number to thereby measure a relative size of said particles.

126. (previously presented): The recording medium as set forth in claim 119, wherein said method further includes scanning said laser beam.

127. (previously presented): The recording medium as set forth in claim 119, wherein said method further includes:

calculating a total of brightness of pixels in said group; and

comparing said total to a predetermined threshold brightness to thereby measure a relative size of said particles.

128. (previously presented): The recording medium as set forth in claim 119, wherein said method further includes storing a software program used for calculating a size of a particle in accordance with the equation of Rayleigh scattering, and a threshold size to which a calculated size is to be compared.

129. (previously presented): The recording medium a set forth in claim 119, wherein said method further includes:

measuring an intensity of said scattered laser beam, based on brightness of pixels in said group; and

measuring a relative size of said particles, based on said intensity of said scattered laser beam, in accordance with an equation which defines a relation between an intensity of a scattered laser beam and a relative size of particles.